

GRAND TRUNK RAILWAY OF CANADA.

Specification of a Locomotive Engine of 4 ft. 8½ Gauge, with
Cylinders 17 x 24 inches.

Price \$8000 U.S.C.

For a Passenger Engine the Driving Wheels must be 5½ feet diameter, and for a Freight Engine 5 ft.; centres of Driving Wheels 8 ft.; from do to Truck and Cylinder centre 10 ft. 5"; Truck centres 5 ft. 6".

BOILER—Telescope Boiler 4' 3" largest outside diameter, x 10' 5" long; barrel to be in 3 plates; outside fire box is to be of the straight top description, 5' 11½" long x 6' 11" deep x 3' 6½" wide,—all boiler plates ⅝" thick, except throat plate, which is to be 7-16" thick. One steam dome 2' : 2" diameter x 2' : 3" high, of 7-16" plate, flanged, riveted, and stayed as shown in drawing No. 1164. The cast-iron cover is 1½" thick having 8 ribs 3" deep x ⅝" thick and secured by thirty-two ¾" studs to 2½" square wrought iron ring, rivetted inside at top of dome. Furnace of 5-16" approved steel, 5' : 4½" deep, x 5' 3" long, x 2' 10" wide, with a 3½" water space all round, the ring at bottom is 2½" deep and riveted by ¾" rivets, 1½" pitch. One row of hollow water space stays (⅜" hole) all round box, about 12" above grate level. Other screwed stays are ⅞" diameter, screwed 12 threads to the inch, and spaced not more than 4½" centres. Crown stays are ⅞" diameter, riveted. For cross bars 2 plates 6" x ¾", with ends welded together and clip washer on top and tapered ferrules below, may be used if preferred to the solid forged crown bar shown in drawing. In either case the ends of these bars must be carefully hand-fitted to front and back edges of crown. Tube plate in furnace of ½" steel; tube plate in smoke box of ⅝" iron flanged and secured to barrel by 3½" angle iron with ¾" web. All iron used to be of best York-

Boiler.—

shire or other equal and specially approved brand. All rivets $\frac{3}{4}$ " diameter and $1\frac{1}{2}$ " pitch with $2\frac{1}{2}$ " lap when single riveted. Longitudinal joints in barrel and barrel to fire box are double riveted. The heads of all rivets to be properly set up. No drifting will be allowed; if the rivet holes are not fair they must be rimmed out. The joints are to be carefully caulked on both sides, care being taken not to injure the plate. 159 wrought iron tubes, manufactured by "National Tube Co.," or "Morris Tasker & Co.," 10' : 10" long x 2" outside diameter and No. 12 W. G. thick. Joint to be made with copper ferrules, No. 16 W. G., about 1" long, driven into tube plate outside the tube. Three gusset stays of $\frac{1}{2}$ " plate and 3" angle iron in back and two in front of boiler are required, also eight socket ended stay riveted inside barrel, and having 1" bolt screwed through the steel tube plate into the socket stays, as shown in drawing. Smoke box 4' : $9\frac{1}{2}$ ' diameter x 2' : $6\frac{1}{2}$ ' long of $\frac{1}{2}$ " Staffordshire plate; door and front end to be of cast iron with at least a 3' : 4" opening. A strong diagonal stay of wrought iron from smoke box to front of frame is required. Boiler is bolted tight to frame only at the smoke box, at every other point it is to have free longitudinal movement. For details of the boiler see drawing No. 1164. Great care must be taken in the curving and flanging of all boiler and fire box plates, and no liners will be allowed at corners of fire box ring or elsewhere. Smoke stack 17" outside diameter of No. 9 best Pennsylvania iron, with cast iron cone and strong wire netting, (to drawing) not to be higher than 14' : 9" from rail, the base castings to be well bolted together and to smoke box plate. Coal burners to have cast iron rocking grate worked by wrought iron levers and rods from foot plate. Ash pan of $\frac{1}{4}$ " plate x 12" deep, with back and front dampers worked from foot plate by wrought iron gear; also side sliding doors with catches, all quite air tight. The ash pan is carried by eight 1" cotter bolts tightly screwed into water space ring.

REGULATOR, &c.—Balanced double poppet valves and upright dome pipe of cast iron with brass joint rings, and $5\frac{1}{8}$ " inside and $5\frac{1}{2}$ " outside diameter, wrought iron dry pipe and cast steam pipes $4\frac{1}{4}$ " diameter in smoke box; to have a small brass relief valve in very strong cage with spring, &c., complete, on top of upright dome pipe. Long wrought iron pipe to be well stayed to top of barrel. Handle and gear to drawing No. 1213

CYLINDERS, &c.—(Right and left reversible) one cylinder, steam chest and half saddle in one casting, of hardest close-grained metal, as hard as can be bored and planed, free from blow holes, strongly bolted together, to frame, and to smoke box, and also further secured by shoulders forged on frame, against which it is held tight by steel wedges as shown by drawing No. 1206. Cylinder 17" diameter x 2 : $7\frac{1}{4}$ " x 1" thick, covers of cast iron each secured, by twelve $\frac{3}{4}$ " studs, as per drawing No. 1073. Slide valves of cast iron to have 5" travel and 1" lap. Steam parts are 15" x $1\frac{1}{8}$ " and exhaust parts 15" x $2\frac{1}{2}$ ". Steam is admitted to both ends of steam chest; chest is to have only one cover on top secured by 26 studs $\frac{3}{4}$ " diameter, a blind brass gland in front and a double gland in rear. Exhaust pipes of cast iron with removable tips 5" diameter, lifting pipe to be of wrought iron made so that its height can be varied at pleasure. Piston head of cast iron with rings of brass set out by 5 bow springs and set screws, &c. Piston rod 3" diameter of steel, screwed in piston head, and then secured by $\frac{3}{4}$ " screwed key. Solid brass glands and bushes of very hard metal to be used in cylinder and steam chest. All the steam tight joints about the engine are to be scraped or ground in, as nothing more than a little linseed oil will be allowed for making the joint. Crosshead of hard cast iron, with steel cotter, to drawing No. 1207. Connecting and side rods of best hammered scrap iron to drawing 1081, finished bright, the bearings to be of hard brass. All bolts and keys to have the necessary flat cotters

Cylinders, &c.—and split pins behind check nuts. G. T. R. style of oil cups on all parts of motion.

MOTION.—Motion of the shifting link description in front of belly stay, balanced by spiral spring. (The arms of reversing shaft work through slot cut in belly stay) For reversing handle and cast iron quadrant see drawing No. 1215. Rocking shaft $3\frac{1}{2}$ " diameter x $13\frac{1}{2}$ ". Reversing shaft $2\frac{3}{4}$ " diameter (all arms to be forged on), the whole to be of best Yorkshire iron, and finished bright; bearing brackets for these shafts are of cast iron and finished bright. All working joints pins, &c., well and deeply case hardened. Reversing spring is a spiral $3\frac{3}{4}$ " diameter and about 18" long, formed of round steel 9-16" diameter. Cage for spring of cast iron and turned up bright. Four straps and eccentrics of cast iron (5" throw) secured by keys, setscrews, and cotters as shown in drawing No. 1077. Wrought iron eccentric rods 5' : $6\frac{1}{4}$ " long centres. Eight motion bars of steel 3' : $9\frac{1}{8}$ " long x $2\frac{7}{8}$ " wide x $1\frac{1}{4}$ " thick tapering to $1\frac{1}{2}$ " secured by collar bolts as shown in drawing No. 1207. Ferrules on motion pins are to be of steel well case hardened, and to be 1-32" longer than the eccentric rod jaws are wide.

FRAMES.—Bar frames, solidly forged of best hammered scrap iron. Section in rear $3\frac{1}{2}$ " wide x 4"; section in front 6" x 2" to be planed or slotted to receive the cylinders, expansion, rocking and reversing shaft brackets, horn stays, wedges and all other connections. Only one bolted joint is allowed, and this must be very carefully fitted and secured by eight $1\frac{1}{4}$ " bolts. Jaws faced with cast iron wedges, each having two $\frac{3}{4}$ " studs and one $\frac{3}{4}$ " set bolt. Frame well stiffened transversely by belly and other cross stays, as per drawing (No. 1205,) none of which must be fastened to boiler. The lower horn stays are of cast iron with $1\frac{1}{2}$ " tie bolt passing through them. All holes in frame to be carefully rimmed, and bolts to be a tight driving fit. The turned portion of each bolt is to be 1-16" larger in diameter than the screwed end, the diameters given

Frames.— are for the screwed ends only. Expansion brackets of wrought iron to clip frame carefully secured by $\frac{3}{4}$ " studs to fire box, these studs are screwed 12 threads to the inch. Front foot plate, 3-16" thick; back foot plate and draw plate $\frac{3}{8}$ " thick; back plate $\frac{1}{2}$ " thick, all strongly bolted to frame. The draw casting is secured between the foot plate and the draw plate. Two $\frac{7}{8}$ " safety chains and hooks are to be provided, spaced 2' : 6" apart.

PUMPS, &c.—One pump of brass to drawing No. 1115; it must be well secured by iron bolts, each having 2 nuts. Feed and delivery pipes of copper $2\frac{1}{4}$ " outside diam., No. 9 W. G. thick. The feed pipe must be well stayed for its whole length. Delivery check valve cage of cast iron; valve and outer casing of brass; casing finished bright. Pump to have a brass cock on top chamber connecting a $\frac{3}{4}$ " iron pipe running into cab, and at this end to have a two way valve, one way connected to 3 or 4 feet of flexible rubber pipe and a small brass branch or nozzle; and the other way connected to a pipe leading down into ash pan at one corner, clear of damper and mud plugs. One No. 8 injector by Mack, or Seller's, on L. H. side with the necessary handles in cab and copper pipes, all complete.

WHEELS.—Wheels to have cast iron centres (4' : 8" diameter for freight and 5' : 2" diameter for passenger) with heavy balance weights cast in, and hollow oval spokes; to be so good a fit upon axles as to require a pressure of about 60 tons to put them on; they must be securely keyed to axle by a key $1\frac{1}{2}$ " x $\frac{7}{8}$ " in section, tyres to be of approved steel $5\frac{1}{4}$ " x $2\frac{1}{2}$ " thick to finish to 5' : 1" and 5' : 7" outside diameter, to be well secured to cast iron centre by 1" fine screwed bolts between each alternate spoke of wheel extending $\frac{3}{4}$ " into metal of tyre. Crank pins of steel $4\frac{1}{2}$ " diameter in wheel hub; connecting rod bearing 4" x 4"; side rod bearing $3\frac{1}{4}$ " diameter x 3" long, to be tightly driven, and the inside end carefully riveted over.

DRIVING AXLES.—Axles 7" diameter, journals 8" long and 3 : 11" centres. Collars forged on, to be of best hammered scrap iron, approved make, perfectly sound and truly turned; axle and sponge boxes of cast iron. Bearings to be of hard brass 1" thick, turned outside and tightly driven into slotted axle boxes.

SPRING GEAR.—Compensating beam of best hammered scrap iron with steel bearings, this beam is to go between drivers on top of frame; the centre pedestal being well bolted to frame. Springs are to be of Krupp's best spring steel or equal and approved quality, with 12 plates $\frac{3}{8}$ " thick x $3\frac{1}{2}$ " wide and 3 : 1" centres; spring links to be of wrought iron; and all keys or cotters to be of steel. Spring seat on top of axle box is to be of cast iron, see drawing No. 1201.

TRUCK.—Side frames $3\frac{3}{4}$ " x $1\frac{1}{8}$ " and $3\frac{1}{2}$ " x $1\frac{1}{4}$ " with the compensating beams $4\frac{1}{2}$ " x 1" of wrought iron. Fixed saddle and jaws of cast iron strongly bolted to wrought iron side frame (see drawing 1109). Solid plate wheels 28" diameter for freight, and 30" diameter for passenger, deeply chilled on rim and tightly pressed on to axle. Two springs of Krupp's best steel, or equal and approved quality, each having 17 plates $3\frac{1}{2}$ " x $\frac{3}{8}$ " x 2 : 11" centres. Axles of best hammered scrap approved make, inside bearing journals 3 : $8\frac{1}{2}$ " centres: 7" long x $4\frac{1}{2}$ " diameter. Wheel seat $4\frac{1}{2}$ " diameter, diameter at centre $4\frac{1}{4}$ ". Axle and sponge box of cast iron; bearings of brass $1\frac{1}{8}$ " thick, carefully hand-fitted into box. The centre casting is secured to truck saddle by a wrought iron king pin 5" diameter and a large split cotter.

CAB, PILOT, &c., &c.—Cab to be of well seasoned ash or walnut, as per drawing No. 1126, with 2 sliding windows in front and 2 on each side and 2 in back board of thick plate glass, also 2 doors in front. The whole to be strongly built and firmly secured to fire box and foot board by suitable bent angle irons, plate and stays, also to be secured to cast iron bracket, bolted on each

Cab Pilot, &c.—end of back plate; to be neatly painted and varnished (varnished only if Walnut); to have all necessary hardware fittings and brass handles. Seats to be formed by tool boxes with strong spring cushions on lid. Pilot of oak or ash with vertical bars and wrought iron tie rods, straps, and diagonal stays, &c., as per drawing. Buffer beam oak or ash 9" x 9" x 8' 8" long, and bolted to angle irons provided on end of frame by $1\frac{1}{8}$ " bolts. Push bar casting to stand well out beyond face of pilot, to have strong wrought iron push bar, also a hook for attachment of tail rope. A hard wood foot board in two lengths, faced on outer edge with $\frac{1}{8}$ " brass bead and supported by brackets on each side of boiler. The brackets are secured to cast iron distance pieces not to boiler plate directly. This board will carry the $\frac{1}{8}$ " splashers plate over the drivers. (The above mentioned brass beading is formed by cutting a 2" tube up its centre line.) Boiler, dome, and cylinder, &c., are to be cased with wood, covered with Russia plate, and secured by bright brass bands. Cylinder, covers, steam chest, and dome to have cast iron caps, &c., all painted. Engine and tender to have 2 coats of good paint (to pattern supplied) striped, and well varnished. Long and convenient steps are required on both engine and tender.

BOILER MOUNTINGS, &c.—One patent steam pressure gauge, Utica make, to indicate 200 lbs. per sq. inch. Top of band in brass pipe to gauge must not be higher than underside of dial. 2 warming cocks with copper pipes. One glass water gauge with frame and lamp stand complete, G. T. R. style. Gauge is bolted to back plate of fire box, and so arranged that, when the water falls below sight in the glass tube, there shall still be 2" of water over the crown sheet. 3 water gauge cocks with wood handles, drip pipe and dish complete; 1 pet cock for pump worked from cab; 3 frost cocks for pump, so arranged as to clear pump, chambers, valves and pipes of all standing water; one blow off cock in rear worked from foot plate; 2

Boiler Mont.—lazy cocks on feed pipes with handles on foot plate (the above cocks and gauges all of brass). Double slide fire door of cast iron with wrought iron levers, &c., complete. One wrought iron dish for carrying tallow can is placed over fire hole door. 2 iron hand rail tubes with brass pillars, &c., from cab to front end of smoke box. These pillars are screwed into cast-iron distance blocks, the blocks being secured by two bolts with countersunk heads. One head lamp bracket complete. One whistle on top of dome worked from cab. Two safety valves, one $2\frac{1}{2}$ " diameter, Ashcroft's nickel seated, completely out of engineman's control, and one of the common description 4" diameter, with lever and spring balance inside of cab; four brass cylinder cocks, worked from cab by wrought iron rods and levers. Two brass tallow cups for steam chest, fed through a $\frac{3}{4}$ " outside diameter brass pipe from cab. One jet cock or blower. One sand box on top of boiler, with handles, rods, levers, valves, and copper pipes leading down to rail on both sides of engine. One stand and bell (all worked from cab). One brass gong on roof of cab 6" diameter. Two fusible plugs in crown plate of furnace. Nine washing out plugs of brass, size and arrangement shown in drawing. A $\frac{3}{8}$ " thickening plate must be riveted inside of boiler plate at all points where holes are tapped through for mud plugs, except in the front tube plate. Splashers of $\frac{1}{8}$ " plate required over driving wheels, the edges of plate faced with brass, section $1\frac{1}{4}$ " x $\frac{1}{8}$ ". An iron splasher plate $\frac{1}{8}$ " thick is required over each truck wheel. Fire brick arch and wrought iron baffle plate in furnace door of coal burners. The number of the engine in 5" brass figures is to be riveted close to top of smoke box door. Upon no consideration will the contractor be allowed to omit large size round split pins in ends of truck bolts, motion pins and other bolts as shown in the various detail drawings.

TENDER.—Wrought iron frame to drawing. Tank to hold 2000

Tender.— imperial gallons. The coal capacity is $5\frac{1}{2}$ tons (40 cubic feet = 1 ton.) Plate on top, bottom, and sides of coal space $\frac{1}{4}$ " thick, remainder 3-16". Baffle plates also 3-16" thick, all of Pennsylvania iron. Rivets $1\frac{1}{2}$ " centres, $\frac{3}{8}$ " diameter for sides, and $\frac{1}{2}$ " diameter for bottom. Coving is not to be more than 8 feet above rail level. Tank well secured to frame by eight $\frac{3}{4}$ " bolts. Two feed valves, with handles, cast iron bends, and hose connections, &c., complete. One man hole and cover, with a loose wire strainer inside to keep out coal and dirt, strong coupling castings, each secured by four $1\frac{1}{4}$ " bolts, are required, both back and front. Trucks are to have iron side frames of bar iron, section 4" x 1", and oak cross beams, section 12" x 8", with an $1\frac{1}{2}$ " iron truss rod on front truck. Axle journals 6:4" centres x 6" long x $3\frac{1}{2}$ " diameter, wheel seat $4\frac{1}{2}$ " diameter. Cast plate wheels 30" diameter and deeply chilled on rim, spaced 4' : 0" apart. The front truck is centre bearing and the rear truck side bearing; Krupp's steel springs, all to drawing No. 1208. A complete set of brakes on trucks that may be worked by hand wheel when necessary, also Smith's vacuum brake on passenger tender and in freight engines to be attached to driving wheels of engine also. Engine and tender must be capable of being turned on a 44' : 6" turntable, and from point of pilot to rear of draw casting on tender must not be more than 51 feet.

TOOLS.—Each Engine to be supplied with 2 bottle jacks, $2\frac{1}{2}$ " diameter screw. 2 chains $\frac{5}{8}$ " diameter and 12 feet long, with 3" ring at one end and a hook at the other. One set of steel wrenches for engine use. One set of gland packing irons. One 16" and one 10" monkey wrench. One $2\frac{1}{2}$ lb. hand hammer. One 10 lb. double-faced hammer. Three flat chisels. One set of plugging irons for tubes. 12 tube plugs. One set of fire irons and pinch bars. Two torches for oiling. One $2\frac{1}{2}$ gallon oil can. One 1 gallon oil can. One 4 lb. oil feeder. One 2 lb. oil feeder.

Tools.—

One 2 lb. tallow feeder. One 8 lb. tallow can. One set signal lamps to G. T. R. standard, with cast iron brackets, one low down on right hand side of smoke box door, and one in rear of tender. One set of cab lamps. One 22" head lamp, manufactured by "Dane & Westlake," "Kelly," "Philadelphia Co.," or "Chanteloup." One 5½ lb. axe. One saw, 26" blade. Two fire buckets. Two large size tender tool chests with strong hinges and locks. Two brass flag stands on front buffer beam, or on head lamp bracket, with 2 stands and brass covers for flags.

GENERAL CONDITIONS.—All timber used to be well seasoned and free from shakes, large knots, sap, or any other defect. All castings to be of hard tough metal, smooth, sound and free from blow-holes, &c. Wrought iron where quality is not stated to be equal to Staffordshire, and every make, brand or quality of metal used in the whole construction of both engine and tender is before being so used to be subjected to the approval of the Chief Mechanical Superintendent of the G. T. Ry. Any other metal used will be rejected. Only Whitworth's standard threads to be used in screwing. (Specimen bolts will be supplied.) Boiler to be tested with warm water to a pressure of 200 lbs. per square inch, and with steam to 170 lbs. before lagging is put on, and under these tests is to retain its shape unaltered and be perfectly tight. Springs to be tested untill all camber is taken out, and the plates are straight.

The whole is during course of manufacture subject to the constant inspection and to the ultimate approval of the Chief Mechanical Superintendent of the Grand Trunk Railway, or his accredited Agent, and throughout the whole work, the best material and workmanship is to be used.

The Engines and Tenders to be delivered free and in perfect working order on G. T. R. track at Portland, Me., on or before Sept. 28, 1874. A complete

Gen. Con.— set of detailed drawings will be supplied to the Contractor, which he pledges himself to exactly follow, so that the various parts may be interchangeable not only with those engines he may build, but also with existing G. T. R. engines.

Where the dimensions are omitted in this specification they will be found fully detailed in the drawings, and in the drawings the figured dimensions are to be preferred to scale.

While the foregoing specification sets forth the general details of the Engines and Tenders, the G. T. Ry. Co. reserve the option of such modifications as they may find necessary when completing the detail and working drawings, so long as the general principle and leading dimensions are not interfered with, without any claim for extra payment being allowed. The Contractor will not be allowed to deviate from this specification and the attached drawings without the permission in writing of the Chief Mechanical Superintendent of the Grand Trunk Railway.